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13. SUPPLEMENTARY NOTES

14. ABSTRACT
Wideband sonar transducers find many applications in underwater vehicles. Two methods can be used to design wideband acoustic transducers. The multiply resonant transducer concept has found very limited operational application. Also, new piezoelectric materials have been developed that have very high electromechanical coupling coefficient and provide wider bandwidth. However, no study to date has compared these two design methods for performance and cost differences, and none has investigated the possible additional benefits of combining the two methods in a single transducer element for greater benefit than is available from either separately. That is the objective of the present study.

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Report Information

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Contract Information
Contract Number: N000141010493
Contract Title: Wideband Sonar Arrays for UUV and Weapon System Applications
Program Officer: Maria Medeiros
CO-PI Information:

- None

Abstract
Wideband sonar transducers find many applications in underwater vehicles. Two methods can be used to design wideband acoustic transducers. The multiply resonant transducer concept has found very limited operational application. Also, new piezoelectric materials have been developed that have very high electromechanical coupling coefficient and provide wider bandwidth. However, no study to date has compared these two design methods for performance and cost differences, and none has investigated the possible additional benefits of combining the two methods in a single transducer element for greater benefit than is available from either separately. That is the objective of the present study.

Technical Section

Technical Report File: N0001410104931.doc Cleared for Public Release

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Progress Statement
Activity at the beginning of the Fiscal Year was delayed by the late delivery of the single crystal piezoelectric parts for the transducers. Delivery of the piezoelectric rings was promised in August 2011, but did not actually occur until late November. In the early months of 2012, Mr. Wilson built a single transducer element of his design to verify the assembly processes and procedures. Electrical bench tests of this element showed good performance throughout the frequency region of the two resonances and indicated that the modeled predictions should be obtained in water.
When a second element was built, its alumina (ceramic) headmass broke when the element was prestressed. Further element build was put on hold until the reason for this failure was identified. A more careful finite element analysis of the element under prestress identified that the static stress in the head near the stress bolt was high enough to cause concern in high power testing. It is likely that this relatively high stress in combination with a minor defect in the head caused the failure, as the first assembled transducer does not exhibit this failure.
Further assembly of the remaining elements, leading to acoustical testing in the ARL Acoustic Test Facility would have followed. At that time, however, Mr. Wilson encountered health problems that interfered with his ability to complete the work as scheduled. Project funds were exhausted in June 2012, and while Mr. Wilson did some work through the summer he has not been able to complete his degree. The Graduate Program in Acoustics and his thesis advisors would be happy to assist Mr. Wilson if he is able to return and complete his degree.

Refereed Journal Articles

- None

Books And Chapters

- None

Technical Reports

- None

Contributed Presentations

- Description: Michael B. Wilson, Steophen C. Thompson and Thomas B. Gabrielson,"Design comparison of wideband tonpilz transducers using multiply resonant structures adn high coupling materials," presented at the International Workshop on Acoustic Transduction Materials and Devices, Penn State University, May 8-10 2012.
  Date: May, 2012

Patents

- None

Honors

- None

Related Sponsored Work

- None

ONR Statistics

Grad Students(total):	1
PI/Co-PI Women:	0
PI/Co-PI Minority:	0
Grad Students Women:	0
Grad Students Minority:	0
Post Docs Students:	0
Post Doc Women:	0
Post Doc Minority:	0
Under Grad Students(total:	0
Under Grad Students Women:	0
Under Grad Students Minority:	0

Degrees Granted:	0
Invention disclosures citing ONR support:	0
Other funding sources:	1